

REMARKS

I. Introduction

Upon entry of the present amendment, claims 1 to 17 will be pending in the present application. By the present amendment, claims 11, 14 and 15 have been amended. No new matter has been added herein by the present amendment.

In view of the foregoing amendments and the following remarks, Applicant respectfully submits that the claims are now in condition for allowance. Applicant points out that the amendments made herein are made without prejudice to the future prosecution of such cancelled, amended or modified subject matter in a related divisional, continuation or continuation-in-part application.

II. Rejection of Claims Under 35 U.S.C. § 112

Claims 11, 14 and 15 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Office Action states that claims 11 and 15 lack proper antecedent basis, and that claim 14 is rendered indefinite by the word “preferably.”

By the present amendment, claims 11 and 15 have been amended to include proper antecedent basis, and claim 14 has been amended to remove the word “preferably.”

Thus, Applicant respectfully submits that the rejections of the claims under 35 U.S.C. § 112, second paragraph, have been overcome and should therefore be withdrawn.

III. Rejection of Claims Under 35 U.S.C. § 103

Claims 1 to 5, 7, 10 to 12 and 14 to 17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO 00/02646 (“Verbraak”) in view of U.S. Patent No. 5,891,408 (“Buisman et al.”) and WO 92/17401 (“Grierson”). Claim 13

stands rejected under 35 U.S.C. §103(a) as being unpatentable over Verbraak in view of Buisman et al. and Grierson as applied to claim 1 above, and further in view of applicant's allegedly admitted prior art. Claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Verbraak in view of Buisman et al. and Grierson as applied to claim 1 above, and further in view of U.S. Patent No. 6,368,566 ("Hums et al."). Applicant respectfully submits that these rejections should be withdrawn for at least the following reasons.

In rejecting a claim under 35 U.S.C. § 103(a), the Examiner bears the initial burden of presenting a *prima facie* case of obviousness. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). To establish *prima facie* obviousness, the prior art reference(s) must teach or suggest all of the claim limitations. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). However, "a patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. ___, No. 04-1350, slip op. at 14 (April 30, 2007). Rather,

[o]ften, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and to the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

Id. Further, "the claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose." M.P.E.P § 2145.

The present invention relates to a NO_x removal process by bringing NO_x containing gas into contact with a scrub liquid using a metal ion (e.g., Fe(II)) chelate for converting NO_x to molecular nitrogen. See specification, page 1, lines 1-20. Biomass is used in the process to convert spent chelate (e.g., Fe (III) chelate) to

active chelate (e.g., Fe(II) chelate) – a consequence of which is that the chelating agent can be reused. Additionally, biomass is used to assist the conversion of complexed NO to N₂. The Fe(II) chelate is needed as NO hardly dissolves, and dissolution is improved by binding of NO to the Fe(II) chelate. The biomass (combined with the iron chelate) thus promotes conversion of NO to N₂ and keeping the iron chelate in the active state.

Verbraak is directed to a method for cleaning a waste gas, “which involves the gas being brought into contact with a scrub liquor in a scrubber, the scrub liquor being provided with agents for removing both most of the sulphur oxides present in the gas and most of the nitrogen oxides present in the gas from the gas.” Verbraak, abstract. As described in the present specification, Verbraak “describes a method for the removal of the chelate from the process overflow that is discharged to keep the amount of scrub liquid and contaminants at a suitable level.” Specification, page 2, lines 21-23.

Buisman et al. is directed to a process for purifying flue gas containing nitrogen oxides “in which the flue gas is scrubbed with a circulating scrubbing liquid which contains a transition metal chelate such as Fe (II) EDTA and the complex formed from nitrogen oxide and transition metal chelate and/or spent transition metal chelate is regenerated biologically in the presence of an electron donor, nitrogen oxide being reduced to molecular nitrogen. The biological reactor can be combined with the gas scrubber. The electron donor is, for example, hydrogen or methanol, but may also be sulphite which originates from sulphur dioxide in the flue gas.” Buisman et al., abstract.

Grierson, in contrast to the disclosures of Verbraak and Buisman et al., does not relate at all to a NO_x removal process, but instead relates to a H₂S removal process. Such a process is clearly distinct from a NO_x removal process, and would therefore provide no reason or motivation for one of ordinary skill in the art to combine the teachings of Grierson with those of Verbraak and Buisman et al.

First of all, although an iron chelate may be used in both a NO_x removal process and a H₂S removal process, it has a completely different function in these

two processes. In a NO_x removal process, the chelating agent forms a complex with NO and the transition metal chelate, and thereby NO is converted to molecular nitrogen (see, e.g., specification, page 1, lines 12-20). On the other hand, in a H_2S process the chelating agent serves as a delivery agent for the iron cation only, and it is the iron cation that converts the H_2S into elemental sulphur (see, e.g., Grierson, page 1, lines 13-16). Furthermore, in a H_2S process (such as disclosed in Grierson) the conversion of Fe(III)chelate (in Grierson the active metal chelate form, but in the present invention the undesired inactive metal chelate form) to Fe(II)chelate is done via S^{2-} to form S. Fe(II)chelate is regenerated to Fe(III) chelate by oxygen in vessel 20 (see Grierson, page 14, lines 5-15; figs. 1 & 2).

In a H_2S process in which typically a few percent of H_2S is present in the inlet stream, biomass cannot be used to regenerate spent chelating agent, as biomass will not be able to withstand such severe acidic conditions. Biomass will certainly lose all activity at a relatively high H_2S concentration and most likely not even survive such conditions.

Additionally, assuming *arguendo* that one of ordinary skill in the art were to combine Verbraak with Grierson, Grierson relates to removing all solids from the scrub liquid and retaining only the chelating agent in the process. Or, in other words, Grierson only discloses a membrane filtration step to remove undesirable solids from the system, and a membrane filtration to keep desirable – chelating agent – components in the system. However, in accordance with the process of the present invention, the biomass is to be kept in the scrub liquid. If one of ordinary skill in the art were to consider using the measures of Grierson to keep the biomass in the system by using their filtration step to keep the desirable components in the process (which is only the filtration step used to keep the chelating agent in the process), then the problem that is solved by the present invention would actually arise. That is, biomass would end up fouling the membrane used to retain the chelating agent in the system.

Furthermore, in a H_2S removal process, sulphate scaling is no issue, while sulphate scaling is one of the major problems in a NO_x/SO_x removal process in which a membrane is used to separate off the chelating agent and biomass so that

these can be recycled (see specification, page 3, lines 8-13). In a H₂S removal process as disclosed in Grierson, H₂S is converted to elemental sulphur without any sulphate or sulphite being formed (whereas sulphate scaling is basically the problem addressed by claim 5 of the present application).

Finally, we note that the Office Action states that “[i]t would have been obvious to one having ordinary skill in the art at the time of the invention to modify membrane separation process [*sic*] of Verbraak with the membrane separation process as taught by Grierson since, Grierson states on page 4 line 19-25 that such a separation process would control the build-up of undesirable compound in the scrubbing liquid and also on page 6 line 34-35 that the process improves the usable life of the scrubbing liquid.” (Office Action mailed Nov. 1, 2007, page 5). However, as explained in detail above, Grierson (as well as these cited passages therefrom) do not relate to the presently claimed process. Thus, there would be no reason for one of ordinary skill in the art to combine the teachings of Grierson with those of Verbraak and Buisman et al., and to modify such teachings in order to arrive at the presently claimed invention. Accordingly, the present obviousness rejections are apparently relying on the Applicant’s disclosure and are therefore based on nothing more than improper hindsight, which cannot support an obviousness rejection.

For at least the preceding reasons, it is respectfully submitted that the rejections under 35 U.S.C. §103 should be withdrawn.

IV. Conclusion

It is respectfully submitted that all pending claims are allowable. All issues raised by the Examiner having been addressed, an early and favorable action on the merits is earnestly solicited.

Respectfully submitted,
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